

**The Information System of Mobile Knowledge
Workers: An Activity Theory perspective of
information sources and interaction**

**By
Michael Er**

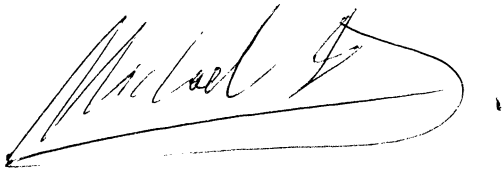
This thesis is submitted by Michael Er
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Certificate of Authorship / Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

A handwritten signature in black ink, appearing to read "Michael Er", with a large, sweeping flourish underneath.

Michael Er

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Abstract

Mobile technology has the potential to connect the mobile knowledge worker (MKW) to information sources which will support their decision making. Many researchers in the fields of innovation adoption and human computer interaction advocate that the development of support technology (such as mobile technology) should be initiated with an understanding of the end user that is based on current work practices, in order to support acceptance and adoption.

The object of this research is to describe the existing information system used by mobile knowledge workers (MKWs).

The assessment of the existing information system of MKWs under examination in this research goes beyond the identification of data and the technical means of data supply. A holistic view of the information system is applied to take into consideration both the existing sources of information which assist in decision making and the interaction and/or access made by the user (MKW) with such systems.

An interpretive philosophical approach was taken via an empirical study of mobile workers in three different contexts. The empirical research resulted in the development of three case studies: Doctors working on ward rounds, Reporters working in the field and construction site workers operating on building sites. The case studies were executed in two rounds, the first round being focussed on the Doctors and Reporters, and the second being a main case study which examined the work practices of construction site workers. Consideration of these MKWs was developed using semi-structured interviews and interpreted through the lens of Activity Theory.

The resulting framework adapted from Activity Theory identifies technical, social and environmental factors which influence the way mobile knowledge workers interact with information sources. Of particular note is the identification of a previously overlooked information source which sits outside the organisation: that of the Contributor. Another significant finding is the preference for information provided by Collaborators over information supplied by information tools. The information provided by Collaborators was preferred as it was subject to the application of Collaborators' knowledge to the situational context.

Publications Supporting this Research

The following publications list peer reviewed papers which are directly related to my research:

Er, M., Lawrence, E., & Kay, R. 2010, 'Information Systems and Activity Theory: A Case Study of Doctors and Mobile Knowledge Work', ITNG New Generations, Las Vegas, USA, November 2007 in *Seventh International Conference on Information Technology*, ed Shahram Latifi, IEEE Computer Society, USA, pp.603-607.

Er, M. 2008, 'Technology Adoption and the Mobile Worker: The Case of the Field Journalist', CollaborateCom, White Plains, USA, November 2007 in *CollaborateCom 2007*, ed Dr. Jonathan Grudin, Dr. Wendy Kellogg, IEEE, Piscataway, USA, pp. 442-446.

Er, M. 2007, 'Developing Mobile Technology for Construction Sites', Australian Universities Building Education Association Annual Conference, Melbourne, Australia, July 2007 in *Australasian Universities Building Conference Association 2007*, ed Kenley, R., AUBEA, Hawthorn, Australia, pp. 140-149.

Er, M. & Underwood, J. 2006, 'Innovation for the mobile workforce: An active theory model', Transformational Tools for the 21st Century, Rockhampton, Australia, October 2006 in *Transformational Tools for the 21st Century*, ed Hasan, H; Wymark, G; Findlay, J, Knowledge Creation Press, Sydney, Australia, pp. 59-63.

Er, M. & Kay, R.J. 2005, 'Mobile technology adoption for mobile information systems: an activity theory perspective', International Conference on Mobile Business, Sydney, Aust, July 2005 in *Proceedings of International Conference on Mobile Business (ICMB'05)*, ed Brooks, W; Lawrence, E; Steele, R; Chan, E., IEEE, Piscataway, New Jersey USA, pp. 322-325.

Er, M. & Kay, R.J. 2005, 'Towards an activity theory perspective on mobile information systems', Australasian Conference on Information Systems, Sydney, Aust, November 2005 in *Proceedings of the 16th Australasian Conference on Information Systems (ACIS 2005)*, ed Campbell, B; Underwood, J; Bunker, D, FIT-UTS, Sydney, Aust, pp. 1-7.

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